(No Model.) 4 Sheets—Sheet 1.

F. R. SKIDMORE.

VALVE CONTROLLING MECHANISM FOR ENGINES.

No. 463,845. Patented Nov. 24, 1891.

Fig. 4.

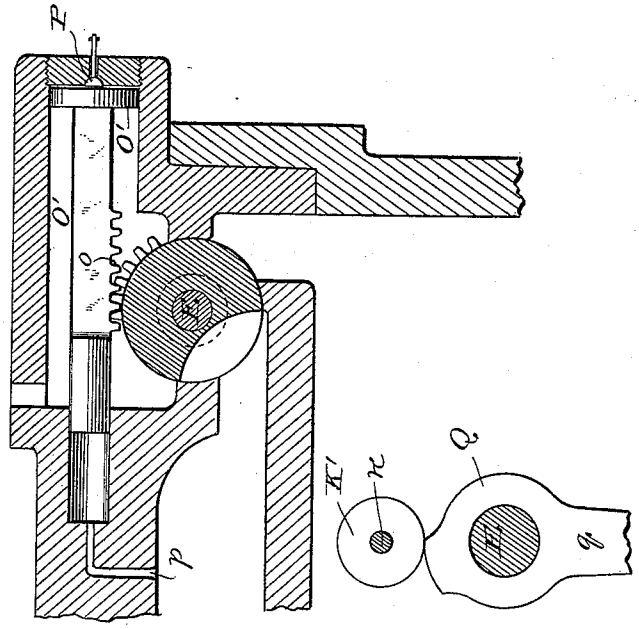


Fig. 2.

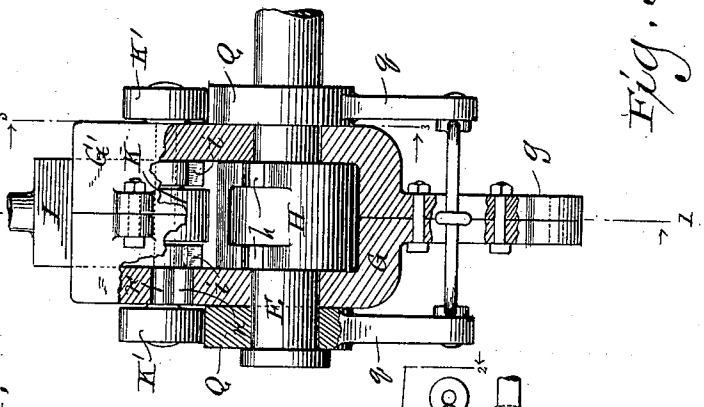
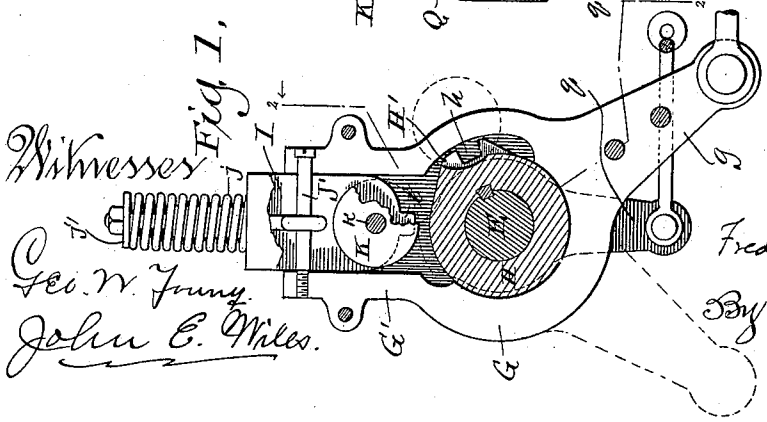


Fig. 3.

Fig. 1.



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(No Model.) 4 Sheets—Sheet 2.

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Fig. 5.

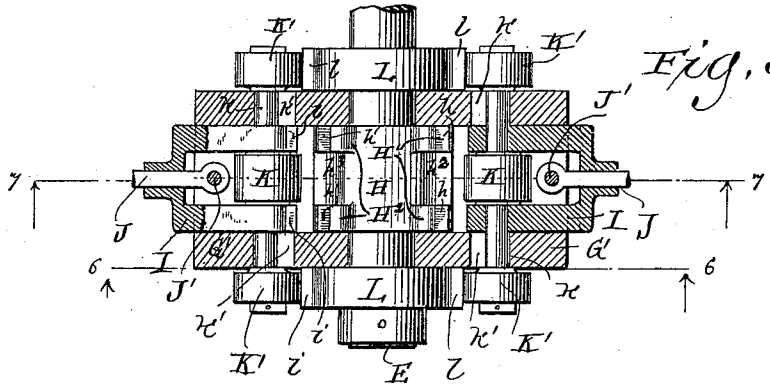

Fig. 6.

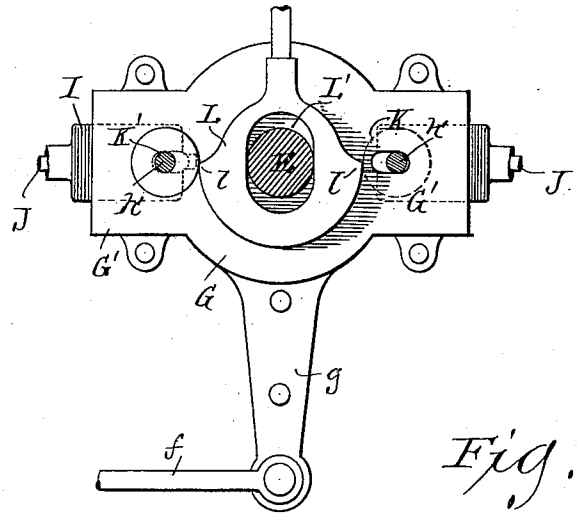

Fig. 7.

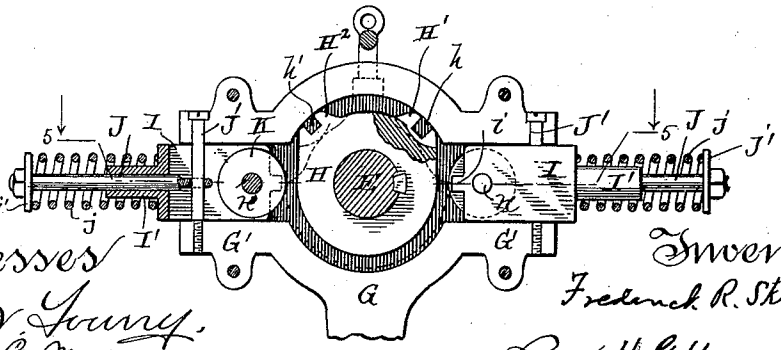

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Fig. 8.

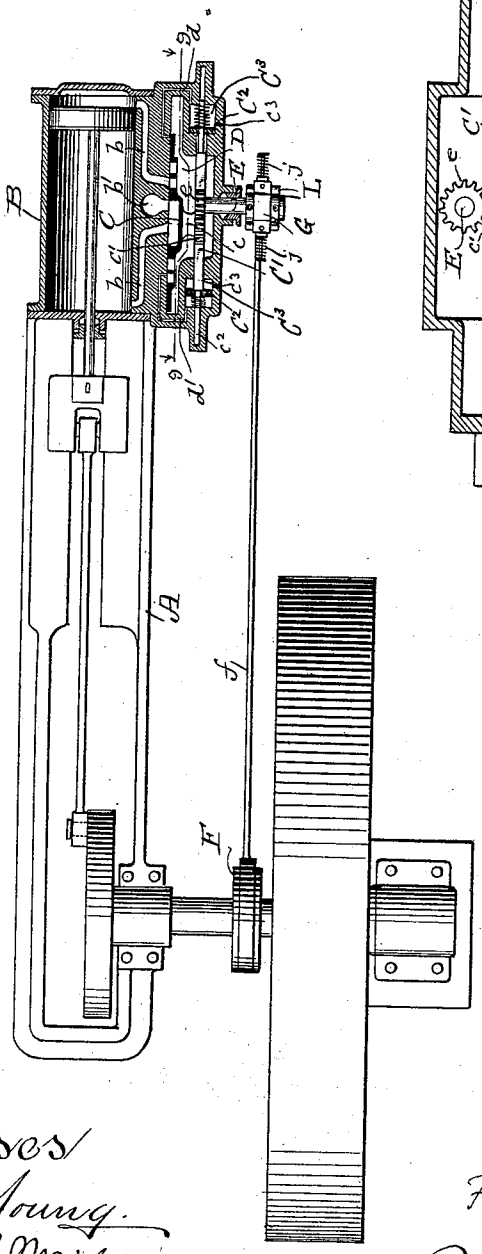

Fig. 9.

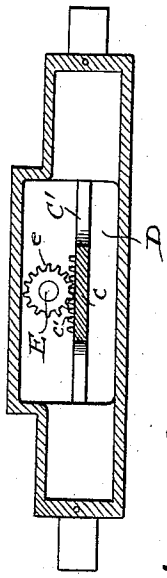

Fig. 10.

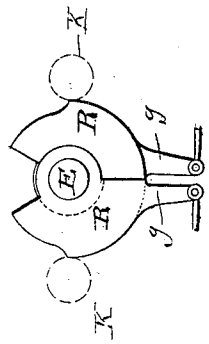

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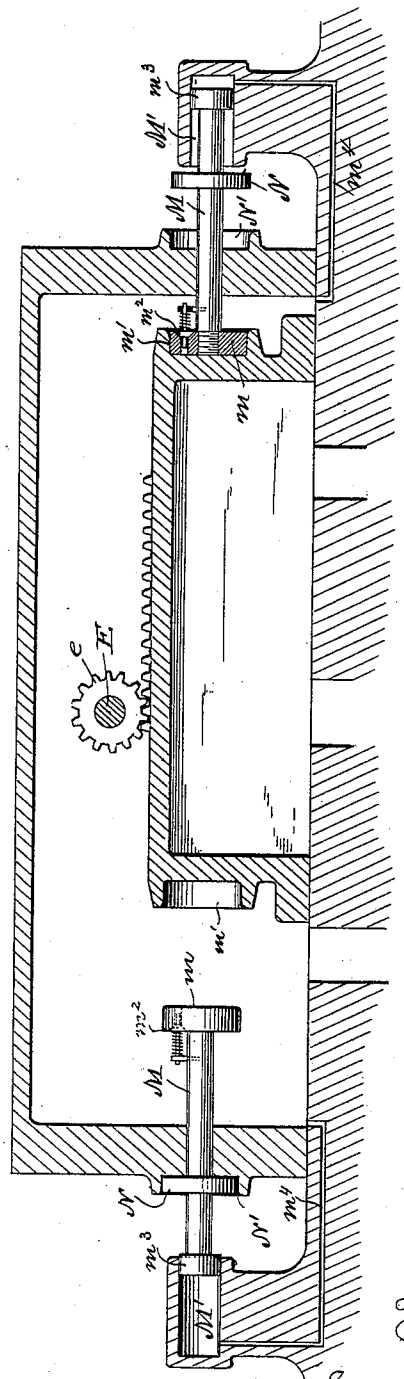
Fig. 11.



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UNITED STATES PATENT OFFICE.

FREDERICK R. SKIDMORE, OF MILWAUKEE, WISCONSIN.

VALVE-CONTROLLING MECHANISM FOR ENGINES.

SPECIFICATION forming part of Letters Patent No. 463,845, dated November 24, 1891.

Application filed June 29, 1891. Serial No. 397,852. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK R. SKIDMORE, a citizen of the United States, and a resident of Milwaukee, in the county of Milwaukee, and in the State of Wisconsin, have invented certain new and useful Improvements in Valve-Controlling Mechanism for Steam-Engines; and I do hereby declare that the following is a full, clear, and exact description thereof.

My invention relates to new and useful improvements in valve-controlling mechanism for steam-engines; and it consists in the matters hereinafter described, and pointed out in the appended claims.

In the accompanying drawings, illustrating my invention, Figure 1 is a vertical section of valve-controlling mechanism embodying my invention, the same being taken on line 1 1 of Fig. 2. Fig. 2 is a vertical section on line 2 2 of Fig. 1. Fig. 3 is a detail view of one of the parts. Fig. 4 is a view of a rocking valve with my improvements applied thereto. Fig. 5 is a horizontal section of another form of my improved valve-controlling mechanism, taken on line 5 5 of Fig. 7. Fig. 6 is a side elevation of the same, partly in section. Fig. 7 is a vertical section on line 7 7 of Fig. 5. Fig. 8 is a view of an engine with my improved valve-controlling mechanism applied thereto. Fig. 9 is an enlarged sectional view on line 9 9 of Fig. 8. Fig. 10 is a detail view of a modified form of one of the parts, and Fig. 11 a view of another modification.

In Figs. 1, 2, 3, and 4 my improved valve-controlling mechanism is shown as adapted for use in connection with single-acting valves of the type commonly known as "Corliss valves," while Figs. 5, 6, 7, 8, 9, and 10 illustrate my device as adapted for use in connection with double-action slide-valves.

I will now describe my invention with reference to Figs. 5 to 10, in which—

A indicates a steam-engine of any desired or familiar construction, B its cylinder, and C its slide-valve, arranged within a steam-chest D and adapted to be operated in any suitable manner by means of a rock-shaft E.

As shown more particularly in Figs. 8 and 9, the slide-valve C is provided with an extension *c*, upon the outer end of which is located a transverse shaft or rod C'. Rack-teeth *c'* are provided upon said transverse shaft or rod C', and a pinion *e* is provided upon the inner end of rock-shaft E.

F indicates the eccentric, and *f* the eccentric-rod. G is a housing revolubly supported upon the outer end of the rock-shaft E and provided with an arm *g*, to which the eccentric-rod *f* is connected. A cam H is keyed to the shaft E and is located within the housing G, said cam being provided with raised portions H' H^2, having notches or depressions *h h* and *h' h'* adjacent to its opposite faces, and with intermediate depressions h^2 h^3, located, respectively, between the raised portions H' H^2. Yokes I I' are movably engaged within extensions G' G^2 on the housing G, the arms of said yokes being arranged in line with the raised portions H' H^2 of the cam H and each provided with a projection *i*, said projections being adapted for engagement with the notches or depressions *h h'*, as will be hereinafter more fully described.

Spindles J J extend outwardly through extensions I' I' on the outer ends of the yokes I I, said spindles J J being secured to the housing G in any convenient manner—as, for instance, by means of bolts J' J', passed through the said housing G and through the open spaces between the arms of the yokes I I, as shown more particularly in Figs. 5 and 7. Upon the outer ends of the spindles J J are provided spiral springs *j j*, arranged to bear at their inner ends against the yokes I I and at their outer ends against stops or shoulders *j' j'* upon the outer ends of spindles J J and serving to press said yokes inwardly. Rollers K K are supported between the arms of yokes I I, as shown in Figs. 5 and 7, said rollers being mounted upon shafts *k k*, which are journaled in said arms of the yokes I I and extend outwardly through slots *k' k'* in the housing G and are each provided with rollers K' K' outside of and upon opposite sides of said housing G. The rollers K K, mounted upon the central portions of the shafts *k k*, are arranged to pass between the projections H' H' and H^2 H^3 upon the cam H as the housing G is rotated by the longitudinal movements of the eccentric-rod *f*, and the rollers K' K' upon the outer ends of said shafts are arranged to engage with the sur-

faces of cams L L, movably supported upon the rock-shaft E adjacent to the opposite sides of the housing G. The cams L L are operatively connected with the governor mechanism in any desired manner—as, for instance, as shown in Fig. 6, in which said cams are provided with slots L′ L′, through which the shaft E passes, and the governor-rod is connected with cams L L in such a manner that a lengthwise movement of said rod will move said cams upon said rock-shaft in a direction lengthwise of the said slots. Raised portions *l l* are provided upon opposite sides of each of said cams L L, said raised portions being so arranged that when the rollers K′ K′ upon the ends of either of the shafts *k k* engage said raised portions by reason of the oscillation of the housing G said shaft will be lifted farther away from the cam H, so as to move the ends of the arms of the yoke I out of line with the notches or depressions *h h* or *h′ h′* in the cam H.

Spindles c^2 c^2 are provided upon the ends of the transverse shaft C′, which are fitted with movable heads C^2 C^2, moving within cylindrical steam-chambers C^3 C^3, to which steam is admitted from the steam-chest D through ducts *d d′*, and from which steam escapes after the heads C^2 C^2 have performed their stroke through ducts or ports c^3 c^3, as will be hereinafter more fully described.

The operation of this form of my improved valve-operating mechanism is as follows: Supposing the parts to be in the relative positions shown in Figs. 5, 6, and 7 of the drawings, as the crank-shaft is operated the eccentric F will be rotated so as to give a longitudinal movement to the eccentric-rod *f*, which in turn imparts an oscillating or rocking movement to the housing G about the rock-shaft E, which normally remains stationary. This rocking movement of the housing G carries the projections *i i* upon the arms of the yokes I I alternately into engagement with the notches *h h* and *h′ h′* in the periphery of the cam H. As the eccentric F moves rod *f* forward the arm *g* on the housing G will obviously be moved to the right, so as to oscillate the housing G and carry the yoke I upon the right-hand side of said housing into engagement with the notches or depressions *h h* in cam H. Now upon the further revolution of the crank-shaft and the eccentric F the rod *f* will be retracted, so as to oscillate the housing G in the opposite direction, when the yoke I will by its engagement with cam H operate to rock or partially rotate said cam, and with it the rock-shaft E. By this partial rotation of the rock-shaft E the pinion upon its inner end will by its engagement with the rack-teeth *c′* on the transverse bar or rod C′ operate to move said bar or rod, and with it the slide-valve C, into the position shown in Fig. 8. This movement of the valve C opens the steam-port at the forward end of the cylinder to take steam and places the port at the opposite end of said cylinder in communication with the exhaust-port, at the same time placing the duct *d′* at the rear end of the cylinder in communication with the steam-supply. As soon as the housing G has moved sufficiently in this direction to bring the rollers K′ K′ into engagement with the raised portions *l l* upon the right-hand sides of the movable or adjustable cams L L the yoke I upon the right-hand side of said housing will be raised out of engagement with said notches *h h*, when steam, bearing against the head C^2 at the rear end of rod C′, will instantly force said rod forward, moving the valve C at the same time into a position to cut off the steam from the forward end of the cylinder, the port at the opposite end of the cylinder remaining in communication with the exhaust and the engine working expansively for the remainder of the rearward stroke of the piston. It will be understood that the valve is stopped in its movement by the piston C^2 reaching the inner end of its stroke; but the pistons C^2 C^2 being loosely mounted upon the ends of the rod and operating against the shoulders on said rod, said rod is permitted a further movement after the piston has reached the inner end of its stroke by means of the pinion *e*, rock-shaft E, and connected mechanism, so as to admit steam at the other end of the cylinder. The valve remains stationary, however, from the time when the piston C^2 reaches the inner end of its stroke until this further movement by said valve-gear is effected. By the time the piston has completed its stroke toward the rear the eccentric F, through the medium of rod *f*, will have operated to rotate the housing G, so as to bring the other yoke I into engagement with the notches *h′ h′* on cam H, so that as the said eccentric passes the center said housing G will be rotated in an opposite direction from the movement above described, but in the same direction as the last-described movement of the parts by the auxiliary piston C^2, to move the valve C into a position to admit steam to the rear end of the cylinder and place the forward end of said cylinder in communication with the exhaust, at the same time placing the duct *d* in communication with the steam-supply. Now when the housing G has been oscillated sufficiently to bring the rollers K′ K′ into engagement with the shoulders *l l* upon the left-hand side of the cam L the yoke I will be raised out of engagement with the notches *h′ h′*, when the steam-pressure upon the head C^2 on the end of the rod C′ will immediately act through the medium of said head C^2 and rod C′ to move the valve C into a position to cut off the supply of steam from the rear end of the cylinder and at the same time from the forward duct *d*.

It will be observed by reference to Fig. 8 of the drawings that the exhaust-ports c^2 c^2 in the chambers C^3 C^3 are so arranged that as the heads C^2 C^2 alternately reach the inner ends of their respective strokes said heads

will uncover said exhaust-ports to permit the escape of steam from said chambers after the valve has been moved sufficiently to cut off the steam from the cylinder, as before described. It will thus be seen that after the valve-gear has operated to move the valve in either direction to open the port leading to one end of the cylinder the steam is cut off instantaneously by the movement of the valve by the auxiliary piston, the valve remaining stationary for a short period during the stroke in either direction, and the valve-gear is then actuated to produce a further movement of the valve to take steam at the other end of the cylinder, when steam is again cut off instantaneously by the release of said mechanism and the operation of the auxiliary piston.

The operation of the valve-controlling mechanism may be regulated so as to cause the valve to cut off at an earlier or later period in the stroke, as may be required, by means of the adjustment of the cams L L upon the rock-shaft E by a movement of the governor mechanism, so as to cause the trip mechanism to operate at any desired part of the stroke of the engine.

In the form of construction illustrated in Fig. 11 of the drawings the shaft or rod C′ is dispensed with, the pinion upon the end of the rock-shaft being engaged with a rack located directly upon the slide-valve, and two shorter rods M M are arranged to slide in bearings at opposite ends of the steam-chest and to engage with opposite ends of the slide-valve. The inner ends of said rods are preferably provided with heads m m, adapted to fit closely within sockets m' m' upon opposite ends of the slide-valve. Outwardly-opening spring-actuated check-valves m^2 m^2 are provided in the heads m m, by means of which steam is permitted to escape from the interior of said sockets as the heads m m are forced into the same, and is prevented from entering the said sockets while the said parts are being drawn apart. Upon the outer ends of said rods are provided heads m^3 m^3, fitted within cylinders M′ M′ adjacent to the opposite ends of the steam-chest. Ducts m^4 m^4 communicate with said cylinders and with the interior of the steam-chest, said ducts being constantly open for the passage of steam. Intermediate heads N N are located upon said rods M M, said heads being arranged to engage with sockets N′ N′ upon the outside surface of the steam-chest.

The operation of this device is as follows: When the rock-shaft is actuated, as before described, to move the slide-valve so as to admit steam to the cylinder, this movement of the valve will bring the socket m' at one of its ends into engagement with the head m on the inner end of one of the rods M. As said parts come together the steam will pass out from the interior of the said socket through the check-valve m^2 in said head, and by the continued movement of the valve the rod M will be forced outwardly against the steam-pressure in the cylinder M′, carrying the head m^3 toward the outer end of the said cylinder. Now upon the release of the valve by the operating mechanism, as before described with reference to Figs. 5 to 9, inclusive, the pressure upon the head m^3 of the rod M, which is in engagement with the valve, will cause said rod to instantly move inwardly until the annular flange N is engaged within socket N′, forcing the valve into a position to cut off the steam. In this position the valve and the head m upon the rod are obviously held together by steam-pressure, inasmuch as steam bears upon the entire surface of the opposite side of the valve, but is prevented by the check-valve m^2 from entering between said slide-valve and the head m. Now when the valve-controlling mechanism actuated by the eccentric is operated in the opposite direction from that before described the slide-valve will be forced away from the head m on the rod M, said rod being held from further inward movement by the engagement of the collar N with the wall of the steam-chest. By the above-described movement of the valve-actuating mechanism the valve is brought into engagement with the other head m and a similar operation of the parts at the other end of the steam-chest takes place. It will be observed that the collars N N, being adapted to fit closely within the recesses N′ N′, will compress the air within said recesses and tend to check the movement of the parts toward the latter end of the stroke of the piston M, thereby serving to prevent any undue jar or noise in consequence of the surfaces coming sharply together.

In the form of construction shown in Figs. 8 and 9 the movement of the valve is checked at the proper instant by the admission of steam against one head C^2 at the same time that it is cut off from the other of said heads.

Now, referring to Figs. 1 to 4, inclusive, it will be observed that an arrangement of parts very similar to that shown in other figures and hereinbefore described is employed to move the valve. In this form of construction, however, the device is adapted to operate a single-acting valve, the valve-operating device being arranged to rotate the rock-shaft E in one direction only and the steam operating to return the parts to their initial position to cut off the steam. In this form but one yoke l is provided upon the housing G, and the cam H is provided with notches h h upon one side only. In this form of construction, as illustrated more particularly in Fig. 4, a piston O is arranged in a chamber O′ adjacent to the steam-chest, and a rack o is provided upon one side of said piston and adapted to engage with the teeth of a pinion on the rock-shaft or with teeth upon a circular portion of the valve. The particular form of valve illustrated in Fig. 4 is a single-acting rotary valve, and is illustrated as mounted directly upon the rock-shaft E. The piston

O is provided at one end with a head o', fitted in one end of the chamber O'. A check-valve P is provided in the end of said chamber, and is arranged to open for the admission of air upon a backward movement of piston O and to close outwardly upon a forward movement of said piston, so as to operate to prevent a too rapid movement of the parts. Steam is admitted, as before described, through a duct p, so as to bear against the end of the piston O. In this form of construction the trip mechanism for releasing the yoke from its engagement with the cam H comprises cams Q Q, revolubly secured upon the shaft E and provided with arms q q, operatively engaged with the governor mechanism, and by which the said cams may be partially rotated about said shaft to cause the mechanism to trip at any desired portion of the stroke. In Fig. 10 is illustrated a somewhat similar form of construction adapted for use in connection with a double-action valve comprising two oppositely-adjustable cams R R, connected with and adapted to be adjusted by the movements of the governor mechanism.

I would have it understood that I do not desire to limit myself to the exact form or forms illustrated in the drawings, as various modifications may be made in the details of construction without departure from the scope of my original invention.

Having described my invention, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. The combination, with the cylinder and the valve for controlling the admission or exhaust of steam, of mechanism connected with the said valve and with the eccentric of the engine for opening said valve, and a piston operatively connected with and adapted to move said valve into a position to close the port, substantially as described.

2. The combination, with the cylinder and piston of a steam-engine and the valve for controlling the admission of steam to or the exhaust of steam from said cylinder, of mechanism connected with said valve and operatively connected with the eccentric of the engine and arranged to operate said valve to open the port, and an auxiliary steam-chamber provided with a piston operatively connected with said valve and adapted to move said valve into a position to close said port, substantially as described.

3. In a steam-engine, the combination, with the cylinder, the piston, and the eccentric thereof, of a valve for controlling the admission of steam to or the exhaust of steam from the cylinder, mechanism operatively connected with said valve and actuated by said eccentric to open the port, trip mechanism for disengaging said mechanism from said eccentric, and a steam-actuated piston operatively connected with said valve and adapted to move said valve into a position to close said port upon the release of said valve by said trip mechanism, substantially as described.

In testimony that I claim the foregoing I have hereunto set my hand, at Milwaukee, in the county of Milwaukee and State of Wisconsin, in the presence of two witnesses.

FREDERICK R. SKIDMORE.

Witnesses:
JOHN E. WILES,
N. E. OLIPHANT.